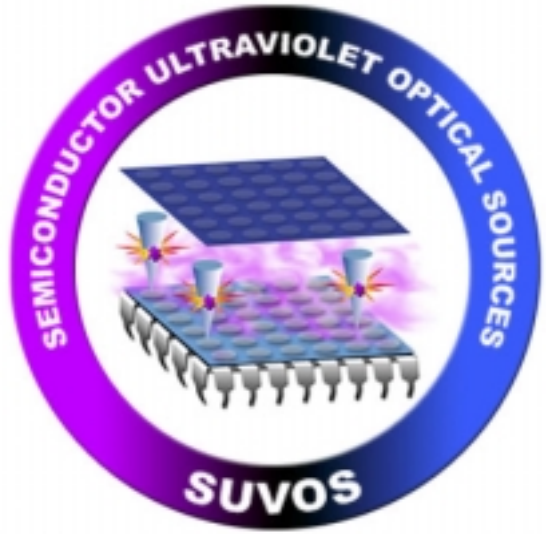
# Semiconductor Ultraviolet Optical Sources

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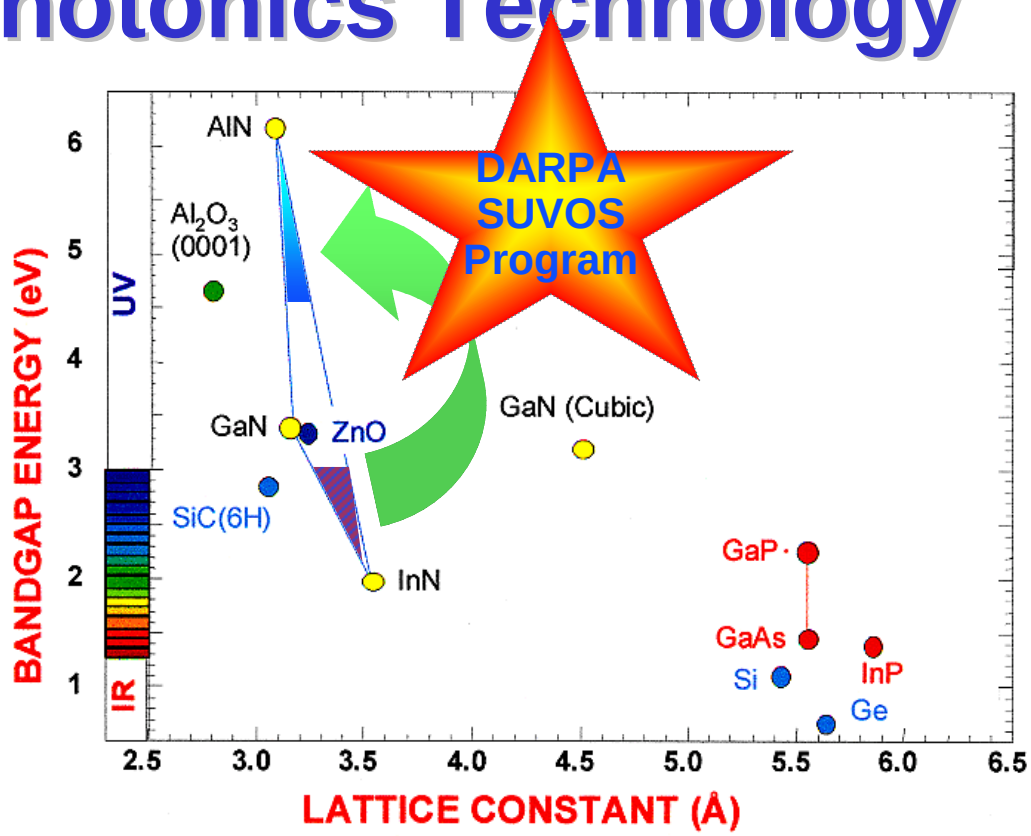
# Wide Bandgap Photonics Technology

## Program Goals:

- Demonstrate semiconductor UV optical sources ($\lambda$ = 280 nm).
- Compared to current non-semiconductor approaches
  - Reduce power consumption by 50x
  - Reduce size/weight by >100x




## Program Challenges:

- *p*-type conductivity of UV materials
- Device Innovation
  - Suppress non-radiative recombination
  - Epitaxial uniformity and strain management

# Program Notes

- 48 month program (BAA 01-49)
  - Phase I (12-18 months) baseline effort
  - Phase II outyears as options
- Exit Criteria Phase I $\Rightarrow$ Phase II
- Primary program focus
  - Optoelectronics
  - Spin-offs to bipolar electronics
- Bidders Brief 8 Nov, Austin TX

# Technology Challenges

- ***p*-type Conductivity**
  - High Al content material
  - Ohmic contacts
- **Device Innovation**
  - Suppress non-radiative recombination
  - Strain management
  - Novel structures
- **Large Band Offsets**
  - Reduce turn-on voltage
  - Enhance carrier transport

# Program Plan

- Task 1: UV Materials Development
  - *p*-type doping (and ohmic contact development)
  - Band-gap engineered heterostructures
  - Suppress non-radiative recombination
- Task 2: Device Innovation
  - 340 nm LED and Laser Diode (NADH)
  - 280 nm LED (Amino Acids, Comms)
- Task 3: Integration and Demonstration
  - Transceiver test bed
  - Bio-detection test bed

# Task 1: UV Materials Development

- Research Challenges:
  - Improve p-type Conductivity
  - Reduce Operating Voltage
  - Enhance Radiative Efficiency
  - Ohmic contact optimization

# Task 2: Device Innovation

- **Research Challenges:**
  - Novel structures
  - Cavity Optimization
  - Light Extraction through contact layers
  - Uniformity and reproducibility
  - Current Injection techniques
  - Thermal Management
  - Strain and Cracking

# Task 3: Integration and Demonstration

- Research Challenges
  - Transceiver test bed development
  - Optical fluorescence test bed
  - Heterogeneous Integration

# Phase I Exit Criteria

- Operating wavelength
- Optical output power
- Quantum efficiency
- Operating voltage
- *p*-type high Al alloy material